Eupatorium coelestinum L. W. Worcester, Sept. 13, 1928. Escape into waste land. *Norman P. Woodward.*

Liatris spicata (L.) Willd. W. Worcester, Sept. 21, 1932. First specimen from New England in the Gray Herbarium. *Norman P. Woodward.*

Bellis perennis L. W. Worcester, May 17, 1933. Spont. in lawns. 4 records. *Norman P. Woodward.*

Aster pilosus Willd. Holden, Sept. 10, 1930. Herbarium sheet in the U. S. Dept. Agri. checked by S. F. Blake. See Rh. **32**: 139 for citation. *Earl W. Bemis.*

Aster amethystinus Nutt., forma leucerythros Bemis. G. Worcester, Oct. 5, 1924. *Earl W. Bemis.* A new form reported by Mr. Bemis in Rh. **32**: 3. Herbarium sheets are also at the Worc. Nat. Hist. Mus. (*Mrs. R. B. Dodge*) (Type in the Gray Herbarium).

Aster amethystinus Nutt., forma leucos Bemis. G. Worcester, Sept. 24, 1930. *Earl W. Bemis.* A new form reported by Mr. Bemis in Rh. **33**: 63. (Type in the Gray Herbarium.)

Aster linariifolius L., forma leucactis Blake. Worcester, Sept. 25, 1926. No herbarium sheet. *Mrs. Frank E. Lowe.* A good stand, a part of which was transplanted to Mrs. Lowe's wild garden where always available. See Rh. **34**: 12 for citation.

Rudbeckia hirta L., forma viridiflora S. H. Burnham. Worcester. Noted in 1928, 1929 and August 22, 1931. No herbarium sheet. Spontaneous in Museum grounds. Several plants. *G. H. Pride.*

Madia sativa Molina, var. congesta T. & G. Worcester (Rice Square), Oct. 28, 1928. No herbarium sheet. *George H. Pride.* Also by *Mrs. R. B. Dodge* in Worcester, June 29, 1929. Herbarium sheet at the Nat. Hist. Soc.

Clark University,
Worcester, Mass.

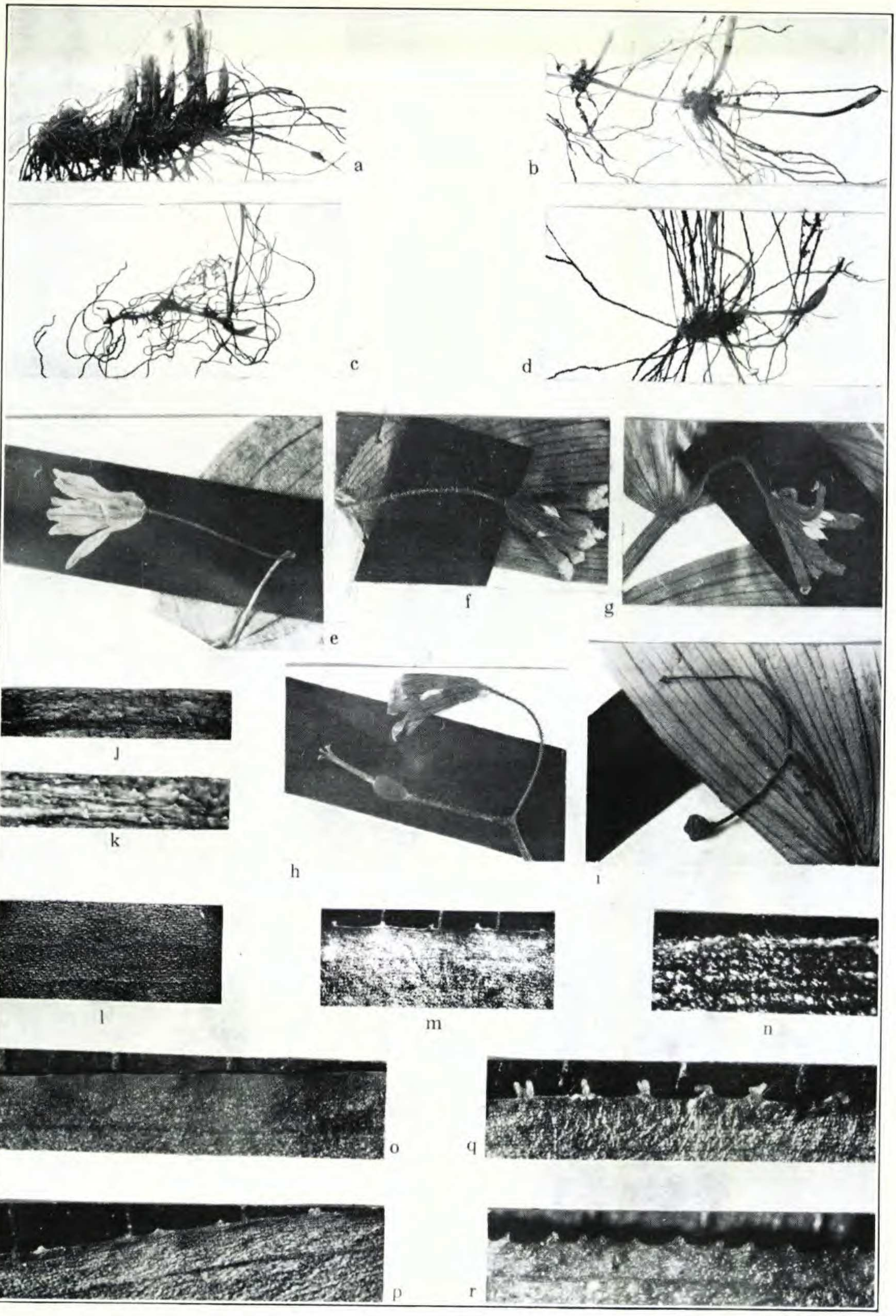
NOTES FROM THE HERBARIUM OF THE UNIVERSITY OF WISCONSIN—XII.
A STUDY OF STREPTOPUS[1]

Norman C. Fassett

Plate 328

This study is based on the material in the Gray Herbarium, the United States National Herbarium, The New York Botanical Garden, the University of Minnesota, the Field Museum of Chicago, the University of Michigan, the University of Montreal, the University of Tennessee, the University of North Carolina, the National Museum of Canada, the Milwaukee Public Museum, the University of Wisconsin,

[1] Printed with aid to Rhodora from the National Academy of Sciences.



DETAILS OF STREPTOPUS.

FIGS. *a–d*, Rootstocks, × ½: *a*, of S. ROSEUS var. PERSPECTUS; *b*, of S. ROSEUS var. LONGIPES; *c* and *d*, of intermediate forms. FIGS. *e–i*, Peduncles and pedicels or flowers, × 1½: *e*, of S. OBTUSATUS; *f*, of S. ROSEUS var. PERSPECTUS; *g*, of S. ROSEUS var. TYPICUS; *h*, of S. ROSEUS var. PERSPECTUS; *i*, of S. ROSEUS var. TYPICUS. FIGS. *j* and *k*, Inner surface of sepal: *j*, of S. ROSEUS var. PERSPECTUS; *k*, of S. ROSEUS var. CURVIPES. FIG. *l*, Lower surface of leaf, S. AMPLEXIFOLIUS var. CHALAZATUS. FIG. *m*, Lower surface and margin of leaf, S. AMPLEX var. DENTICULATUS. FIGS. *n–r*, leaf-margins: *n*, of S. STREPTOPOIDES var. BREVIPES; *o*, of S. AMPLEX. var. AMERICANUS; *p*, of S. AMPLEX. var. DENTICULATUS; *q*, of S. AMPLEX. var. OREOPOLUS; *r*, of S. AMPLEX. var. DENTICULATUS.

and the private herbaria of Mr. C. C. Deam and of Prof. E. Lucy Braun. The writer wishes to express his appreciation to the officials of those herbaria from which he has borrowed material. He is also indebted to Mr. C. A. Weatherby, Professor M. L. Fernald, Professor F. K. Butters, and Professor F. C. Gates for their help in dealing with many phases of this work. To Professor A. J. Eames he is grateful for his notes on stem structure, quoted below.

Generic Characters

STREPTOPUS: perennial herbs, from horizontal rootstocks; stem simple to several times forking; leaves elliptic or ovate, more or less tapering at tip and from sessile to somewhat clasping at base; peduncles supra-axillary, usually fused for some distance with the stem; perianth of 6 separate segments, campanulate or rotate; sepals usually a little broader than the petals; stamens 6; anthers apiculate to aristate at tip; filaments dilated; fruit a berry.

Very characteristic in this genus is the fusion of the lower part of the peduncle with the stem. This has been suggested by Arber[1] in the case of *S. amplexifolius*. Goebel,[2] on the other hand, interprets the arrangement as a sympodium, with each flower terminal, and the apparent extension of the main stem actually an axillary outgrowth. That Arber's suggestion is more correct is indicated by a study of other species. In *S. simplex* (FIG. 1) we find the peduncles borne in an axillary position, but actually leaving the stem at a point a short distance above the leaf. For this short distance, then, the peduncle is fused with the stem; this fused portion is exaggerated in the drawing. In *S. parviflorus* (FIG. 2) the same condition obtains, except that the fused portion is longer, bringing the emergence of the peduncle close to the leaf next above. In *S. amplexifolius* (FIG. 3) the peduncle leaves the stem at a point very close to the leaf next above that in whose axil it was borne, and is often slightly fused with the margin of that leaf. Moreover, the peduncle as it leaves the stem is so twisted that the flower is not directly over the leaf in whose axil it actually arose, but on the opposite side of the stem, hanging under the leaf next above. In all the drawings, the fused portion of the peduncle is indicated by a heavy line. In the plants, there is a low ridge on that side, which is not as conspicuous as the drawings would indicate.

The remaining species have an inflorescence like that of *S. amplexifolius*. Professor A. J. Eames, who has examined microscopically material of *S. oreopolus* collected by the writer on Mt. Washington,

[1] Plant Life in Alpine Switzerland, 256 (1910).
[2] Blütenbildung und Sprossgestaltung, 44–45 (1931).

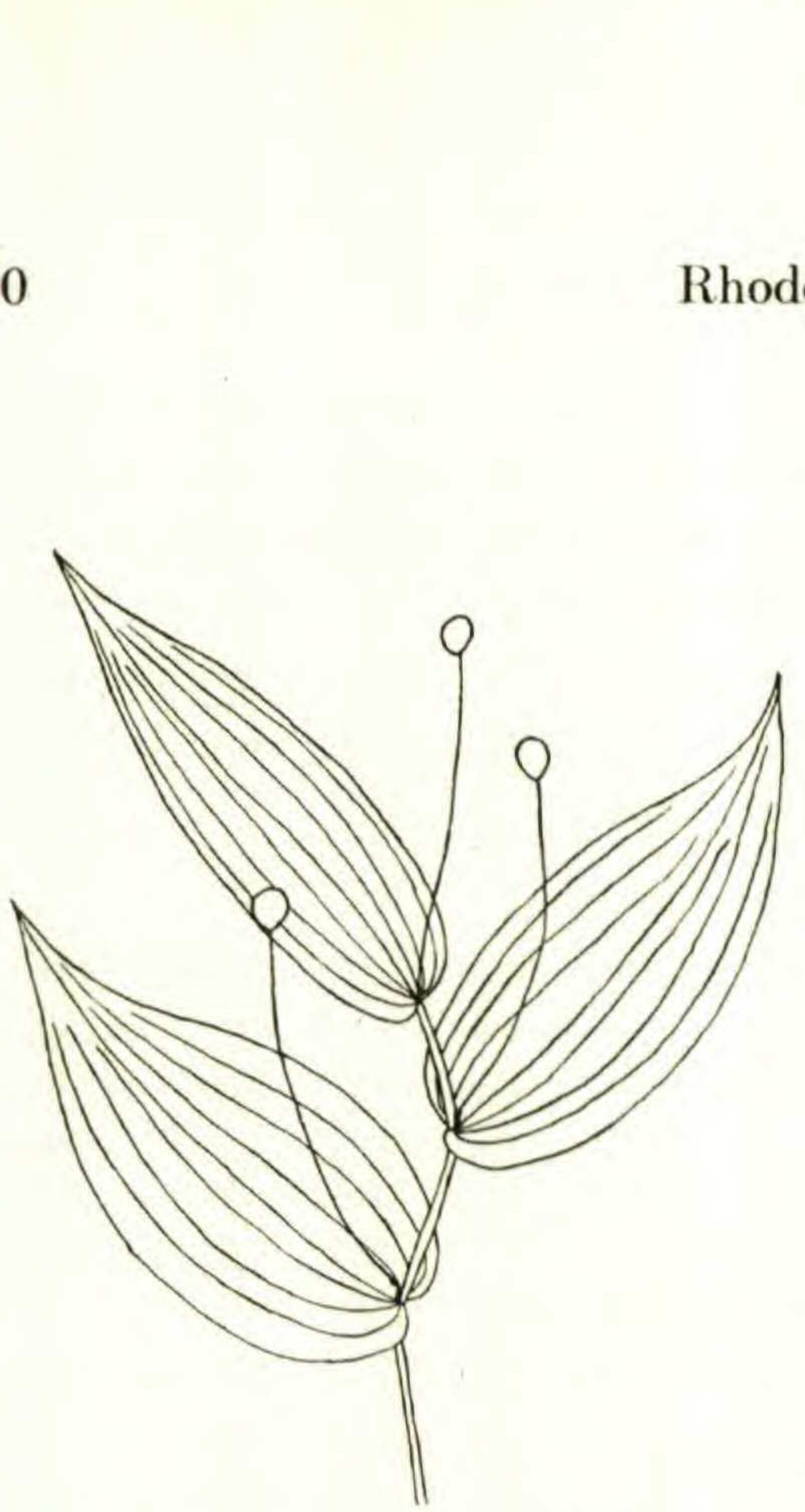


Fig. 1. Streptopus simplex.

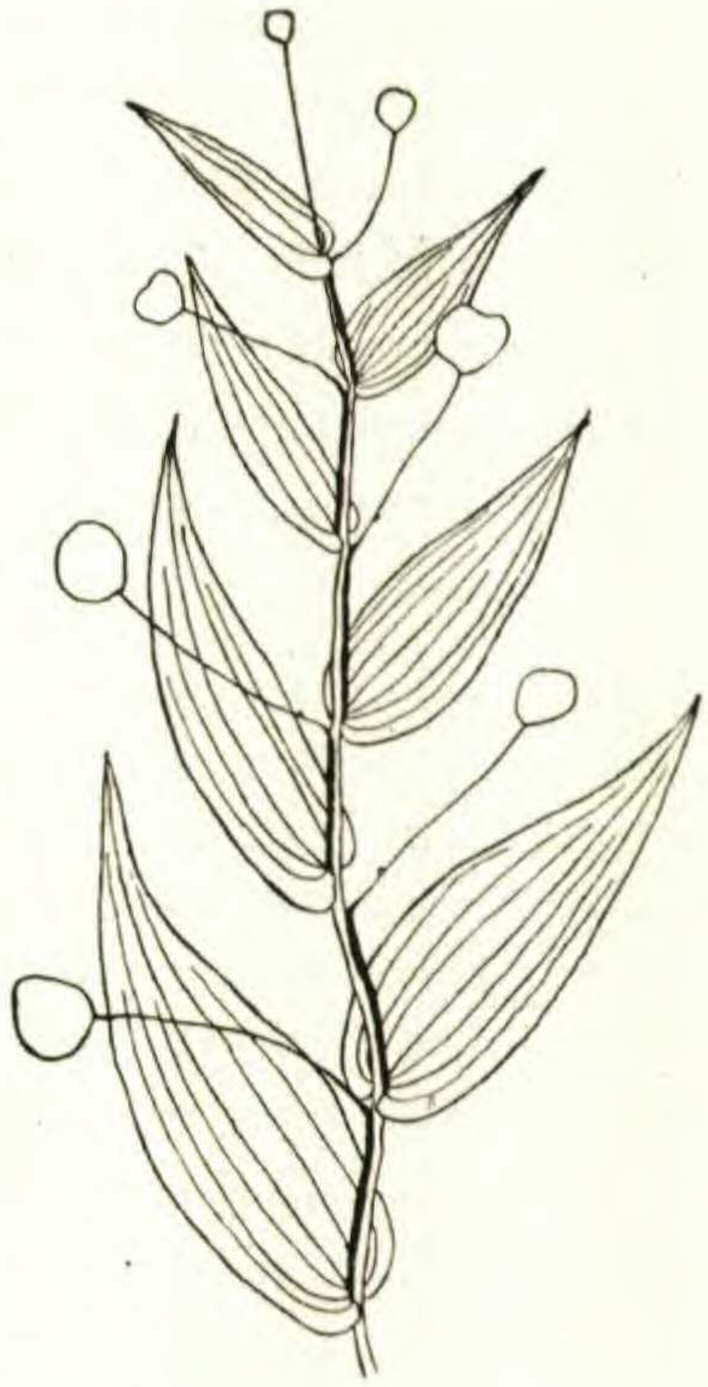


Fig. 2. Streptopus parviflorus.

Fig. 3. Streptopus amplexifolius.

New Hampshire, writes me: "I am sorry to say that there is no convincing evidence internally of the fusion. I had hoped to find it, but the union has apparently become very intimate. This does not mean that I do not think the fusion has not occurred. It surely has. The sections show clearly the unusual relationships of the leaf and peduncle."

The peduncle is sometimes branched, as is shown in FIG. 3, and at the point of branching is a minute bract or gland, representing, no doubt, a leaf. In the case of an unbranched peduncle, there is still a bract or gland in most cases; that this actually represents a leaf is shown by an individual of *S. longipes* which grew in the writer's garden, and which had at that point a green leaf 2 cm. long and several millimeters wide. The portion of the flowering stalk beyond the bract is obviously a pedicel.

S. paniculatus Baker, in Hook, Icon. Pl. xx. t. 1932 (1890) has a very different type of inflorescence, and is out of place in the genus *Streptopus;* the writer will leave to some one more familiar than he with the flora of Asia the placing of this species in its correct genus.

Whether or not *Kruhsea* is treated as a separate genus must rest upon personal judgment. To the writer, two facts seem to warrant the merging of *Kruhsea* with *Streptopus.* The first is the same unique type of inflorescence found in both. The second is the parallelism shown by the variations within each group; the variations in rootstocks, dentation of leaf-margins, and even papillation of perianth-segments, found in *Streptopus* proper, have their counterparts in *Kruhsea.* Only the rotate corolla and sessile stigma separate *Kruhsea* from *Streptopus.* They might stand as not very distinct genera, but as two sections of one genus they are well marked. As for the recently proposed genus *Tortipes,*[1] including only *T. amplexifolius:* if *S. amplexifolius* is treated as a genus distinct from *S. roseus,* then *S. simplex* and *S. parviflorus* are both distinct genera also, and the seven species here distinguished comprise five genera instead of one.

Systematic Treatment

The seven species of *Streptopus* here considered are remarkably distinct, in spite of the similarity of habits throughout the genus. Within several of the species there is considerable variation, but the variation in no cases results in the overlapping of species.

[1] Small, Man. Southeastern Fl. 298 (1933).

a. Perianth campanulate; style filiform; flower-stalk (except often in nos. 1 and 2) with a gland or bractlet representing junction of peduncle and pedicel; nodes glabrous or fringed....*b.*

b. Peduncle emerging from the stem directly above the leaf in whose axil it was borne, and not at all fused with the leaf next above....*c.*

Peduncle only slightly supra-axillary, emerging from the stem at a point close to the leaf in whose axil it was borne; perianth 1 cm. or more long; anther longer than the filament; style-branches nearly 2 mm. long.....1. *S. simplex.*

Peduncle emerging from the stem near the leaf next above that in whose axil it was borne; perianth 8 mm. or less long; anther shorter than the filament; style-branches 1 mm. or less long.....2. *S. parviflorus.*

b. Peduncle twisted at its emergence from the stem, so that it hangs under, and is often slightly fused with, the margin of the leaf next above that in whose axil it arose....*c.*

c. The distal third to half of each perianth-segment widely spreading or strongly recurved at tip; stigma barely 3-lobed; anthers tapering to an entire point; nodes glabrous; leaves cordate-clasping at base.....3. *S. amplexifolius.*

d. Pedicels 8–18 mm. long, usually exceeding the flower or mature fruit; leaves distal to the uppermost flower 3–5, rarely only 1.....var. *genuinus.*

d. Pedicels rarely exceeding 1 cm. in length, usually shorter than the flower or mature fruit; leaves distal to the uppermost flower 1–3, very rarely 4, or the branch sometimes terminated by a flower....*e.*

e. Leaf-margins entire or with very minute scattered teeth not exceeding 6 per cm.....*f.*

f. Leaves minutely but copiously papillate beneath. var. *chalazatus.*

f. Leaves not papillate beneath.....var. *americanus.*

e. Leaf-margins with 10–40 minute teeth per cm., these mostly rather regularly distributed....*g.*

g. Leaf-margins with 10–25 teeth per cm., these mostly wider at base than long; pedicels and leaf-surfaces always glabrous....*h.*

h. Perianth with a spread of 7–16 mm., its segments 7–13 mm. long.

Perianth with a spread of 7–9 mm., its segments 7–9 mm. long; leaves not glaucous beneath.....var. *papillatus.*

Perianth with a spread of 9–16 mm., its segments 8–13 mm. long; leaves glaucous beneath.....var. *denticulatus.*

h. Perianth with a spread of 13–26 mm., its segments 13–17 mm. long.....var. *grandiflorus.*

g. Leaf-margins with 22–40 teeth per cm., these mostly longer than broad or even resembling the cilia of *S. roseus;* pedicels sometimes ciliate; leaves often with scattered hairs below.....var. *oreopolus.*

c. Perianth-lobes slightly if at all spreading at tip; anthers 2-pointed; stigmas definitely 3-parted at tip....*i.*

i. Leaves clasping the stem; stem and peduncles glabrous; nodes not fringed; styles 3-lobed 2/3 of the way to the base; anthers long-triangular, the sides tapering from base to apex; perianth-segments obtuse or rounded at tip.....4. *S. obtusatus.*

i. Leaves sessile but not clasping; stem and usually the peduncles ciliate with multicellular hairs; nodes

fringed; style 3-lobed less than ¼ of the way to the base; anthers ovate, the sides rounded; perianth-segments acute to acuminate (the tips often withering in pressed specimens) ..... 5. *S. roseus.*

j. Rootstock matted, the internodes so short as usually to be obscured by the copious roots, and to cause the current year's stem to appear close beside the remains of last year's; leaves with 22–60, mostly 30–50, cilia per cm.; perianth-segments glabrous within, or rarely with microscopic long low papillae; sepals (7–)9–11-nerved; style-branches mostly ascending. . . . *k.*

k. Pedicels glabrous ..... var. *typicus.*

k. Pedicels ciliate with multicellular hairs. . . . *l.*

l. Perianth 6–10 mm. long; stamens 2.5–5.5 mm. long; mucro on anthers 0.2–0.5 mm. long; style-branches 0.2–0.7 mm. long ..... var. *perspectus.*

l. Perianth 10–12 mm. long; stamens 5–7 mm. long; mucro on anthers 0.5–1.0 mm. long; style-branches 1.1 mm. long. . var. *perspectus*, f. *giganteus.*

j. Rootstock slender, wide-creeping, with internodes several cm. long and small tufts of roots at the nodes; leaves with rarely more than 30 cilia per cm.; perianth-segments minutely papillate-pubescent within; sepals 3–5-nerved; style-branches often spreading.

Stems often branched; leaves mostly with 20–30 cilia per cm.; peduncle and pedicel together 6–22(–42) mm. long; papillae of perianth about 28 mu long. ..... var. *longipes.*

Stems usually simple; leaves entire on the margins or with 16 (rarely –20) or fewer cilia per cm.; peduncle and pedicel together 5–15 (–20) mm. long; papillae of perianth 30–75 mu long. . . var. *curvipes.*

a. Perianth rotate; style absent, stigma conical and sessile; flower-stalk without a gland; nodes fringed. . . . *m.*

m. Perianth-segments not papillate within, sometimes finely pubescent toward the tip; peduncles 3–15 mm. long; leaves margined with minute tooth-like hyaline cells, sometimes also ciliate ..... 6. *S. streptopoides.*

n. Fruit red. . . . *o.*

o. Leaves ciliate ..... var. *verus.*

o. Leaves not ciliate. . . . *p.*

p. Plant 8–20 cm. high, mostly simple; petals with cupped or revolute margins ..... var. *brevipes.*

p. Plant reaching 3 dm. in height, often forking; petals plane ..... var. *japonicus.*

n. Fruit black ..... var. *atrocarpus.*

m. Perianth-segments papillate within; peduncles 1.5–3 cm. long; leaves ciliate, without tooth-like marginal cells. . . . 7. *S. koreanus.*

1. S. SIMPLEX Don, Prod. Fl. Nepal 48 (1825) and Trans. Linn. Soc. xviii. 530 (1841); Schultes fil. Syst. Veg. vii. 312 (1829). *S. candida* Wall. Cat. no. 5112 (1828). *Hekorima candida* Kunth, Enum. iv. 204 (1843).—Specimens examined[1]: INDIA: Sikkim, alt. 12000 ft., *J. D. Hooker* (Gray); Sikkim, alt. 16000 ft., July, 1878, *Dr. King's collector*,

[1] The location of cited specimens is indicated by abbreviations in parentheses as follows: (Gray) Gray Herbarium, Cambridge, Massachusetts; (U. S.) United States National Herbarium, Washington, D. C.; (N. Y.) New York Botanical Garden; (Field) Field Museum of Chicago.

(Gray); amongst scrub and in open forests on w. flank of N'Maikha-Salwin divide, 11000 ft., Upper Burma, June, 1925, *G. Forrest*, no. 26877 (U. S.; N. Y.); margins of thickets on w. flank of N'Maikha-Salwin divide, 13000 ft., Upper Burma, September, 1925, *Forrest*, no. 27255 (U. S.). CHINA: Mount Lauchünchan, southwest of the Yangste bend at Shiku, Yunnan, June, 1923, *J. F. Rock*, no. 9571 (Gray; U. S.; N. Y.); Tibet Himalaya, July 22, 1877, *G. King*, no. 4273 (U. S.); shade of spruce forest, alt. 12,000 feet, Mt. Kenichunpo, May–July, 1932, *Rock*, no. 21947 (N. Y.).

2. S. PARVIFLORUS Franch., Nouv. Arch. Mus. Paris, Sér. II. x. 89[1] (1888); Pl. Dav. 127 (1889). Since the original description is not available in most libraries, it is here reprinted: "Glaberrimus; caulis gracilis, dichotomus; folia late amplexicaulia, ovato-lanceolata, acuminata, subtus glauca; pedicelli capillares, erecti vel ascendentes; flores ex axillis solitarii, albi, parvi; perianthii campanulati segmenta erecta oblonga obtusa; stamina perianthio subduplo breviora, filamentis e basi paulo latiore late linearibus antheras oblongas breviter bicuspidatas saltem aequantibus; stylus stamina vix aequans, breviter tricuspidatus; baccae . . .

"Pedalis usque bipedalis; folia 2–3 poll. longa, 2–2½ cent. lata; pedunculi pollicares; perianthium 6 mill. longum.

"Moupine, in silvis umbrosis. Fl. Jun. 1869.

"Plante grêle à feuilles glauques en dessous; elle tient le milieu entre le *S. simplex* et le *S. roseus* Mich.; elle diffère du premier par ses fleurs deux fois plus petites, par son style très brièvement tricuspidé et non pas divisé presque jusqu'au milieu par ses anthères égalant à peine le filet et non pas une fois plus longues. Il se distingue du second par l'absence complète de poils sur les pédicelles, sur la tige et sur le bord des feuilles, par le périanthe à lobes très obtus et ne se recourbant pas en dehors."

On one of the specimens cited below, the fruit is noted as being "red, berry-like, triangular."

Specimens examined: CHINA: SZECHUAN: Nanchuan Hsien, 1928, *W. P. Fang*, no. 1143 (Gray; N. Y.); Omei Hsien, Mt. Omei, 1928, *Fang*, no. 2831 (Gray); near Tachienlu, at 9000–13,500 ft., *A. E. Pratt*, no. 52 (Gray); western Szechuan, August, 1908, *E. H. Wilson*, no. 926 (Gray; U. S.). YUNNAN: Chungtien, alt. 3600 m., August, 1914, *Camillo Schneider*, no. 2391 (Gray).

There is nothing in the description of *S. Mairei* Levéillé, Bull. Geogr. Bot. xxv. 39 (1915), to indicate that it differs from *S. parviflorus*. This description, kindly supplied by Miss Vincent and Mr. Standley of the Field Museum, is as follows: "Peraffinis *S. amplexifolio* a quo tamen diversus *foliis subtus glaucis* et *pedicello* florali non *articulato*. Flores albi 4–7 mm. diametientes. Yun-Nan: pâtures du plateau de Ta-Hai, 3200 m., Juillet 1912 (*E. E. Maire*)."

[1] The Kew Index lists this as page 90, but the description begins on the previous page. I am indebted to Miss Amy Hepburn of the Columbia University Library for a copy of this description.

3. S. AMPLEXIFOLIUS (L.) DC. in Lam. & DC. Fl. de France iii. 174 (1805).

This species is variable in several respects. The berries, as described by several authors, seem to vary somewhat in color. European writers mention red berries, as do most American, in describing plants from the western portions of the continent[1] as well as from the eastern.[2] It is surprising, therefore, to find the words "berry white" used by Rydberg[3] and by Abrams[4] to distinguish *S. amplexifolius* from *S. curvipes*. Rydberg later[5] characterized this fruit as "scarlet, rarely white." Howell[6] described it as "yellow or red." In this connection, Dr. F. K. Butters wrote to me on April 10, 1933, "Please note the almost black berries on some of the Selkirk Mt. specimens. There are two forms there, one with orange-red berries, the other with crimson-black berries. They often grow together, and studying them in the field I never could discover any other differencies." A specimen from Glacier, British Columbia, collected by Dr. Butters and noted by him as being the black-berried form, seems in its other characters to belong with other plants of the western slopes and of the Lake Superior region; the middle-western plants, at least, ordinarily have red berries. The color of the fruit is not used in this treatment, but it is to be urged that collectors make notes on this character, which may yet prove to have some taxonomic significance.

There may be some variation in rootstocks; a few plants with fragments of underground parts suggest this. That these variations may be at least in part ecological in nature is suggested by specimens of *S. oreopolus* (which seems to be but an extreme phase of *S. amplexifolius*) found by the writer on Mt. Washington, New Hampshire. These grew in the water of a small stream above Tuckerman's Ravine, and had rootstocks so elongate that at least one internode measures 2.5 cm. in length.

The size of the flowers varies throughout a wide range, but with no apparent localization of forms except in northwestern Oregon, where there is a large-flowered extreme, and in Japan, where there is a small-flowered plant. Occasional specimens in both Europe and America

[1] Armstrong, Field Book of Western Wild Flowers 46 (1915). Coulter, Man. Bot. Rocky Mt. Region 347 (1885). Piper & Beattie, Fl. N. W. Coast 102 (1915). Jepson, Man. Fl. Pl. Calif. 248 (1923).

[2] Gray's Man., ed. 7: 292 (1908). Victorin, Contrib. Lab. Bot. Univ. Montréal xiv. 95 (1929). Britton & Brown, Ill. Fl., ed. 2: i. 520 (1913).

[3] Fl. Rocky Mts., ed. 2: 168 (1922).

[4] Ill. Fl. Pacific States i. 457 (1923).

[5] Fl. Prairies & Plains 220 (1932).

[6] Fl. N. W. Am. 658 (1903).

have the perianth-segments minutely papillate within, but this does not seem to correlate with anything else.

In the leaves are found definite characters, but they are so minute as to be almost invisible with an ordinary hand-lens. Throughout this study a binocular microscope was used, with a magnification of 17 or of 28.9 times. A piece of black paper or of blackened photographic film was cut one centimeter wide and inserted under the loose edge of a leaf to be studied. There then become visible on the margins of leaves of many plants minute teeth (PLATE 328, m & p). These are best developed on certain plants about the Pacific ocean and in the upper Great Lake region. They are completely lacking on the plants of the eastern slopes of the Rockies and of most of New England. Some plants of the western slopes of the Rockies (where the denticulate-leaved plants also occur), of the middle west, and of the more northern regions in the east, have occasional poorly developed teeth. These individuals thus grade into the other form, but in most cases the teeth are so sparse and minute that the plants are here treated with the entire-margined ones. To try to separate these varietally would end in absurdity, for it would mean going over every millimeter of leaf-margin to see if perhaps a single minute tooth might be found. In PLATE 328, FIG. o, one small tooth is shown on a leaf classified with the entire-margined group. Although it is impracticable to treat these with the western form, it is perhaps significant that these slightly denticulate leaves are on plants from the north, occurring in Greenland, Labrador, Newfoundland, the Mingan Islands, Anticosti, the Magdalen Islands, the Gaspé Peninsula, and in the northeastern states only on Mts. Katahdin, Washington, Mansfield, and Marcy. Even the plants of Europe have teeth on some of the leaves of every specimen seen by the writer, although the only mention of this character seems to have been made by Watson,[1] who wrote of the western American plant, "leaves . . . very rarely slightly scabrous on the margins."

A definite, if minute, variation occurs in certain plants of the Rocky Mountains, which seem to constitute an offshoot from the widespread entire-margined variety. In these, the lower surface of the leaves is covered with minute papillae (PLATE 328, l); these are readily seen under the magnifications mentioned above, especially if a slight ridge or depression in the leaf allows the light to fall nearly parallel to the surface. They are particularly well developed near the veins.

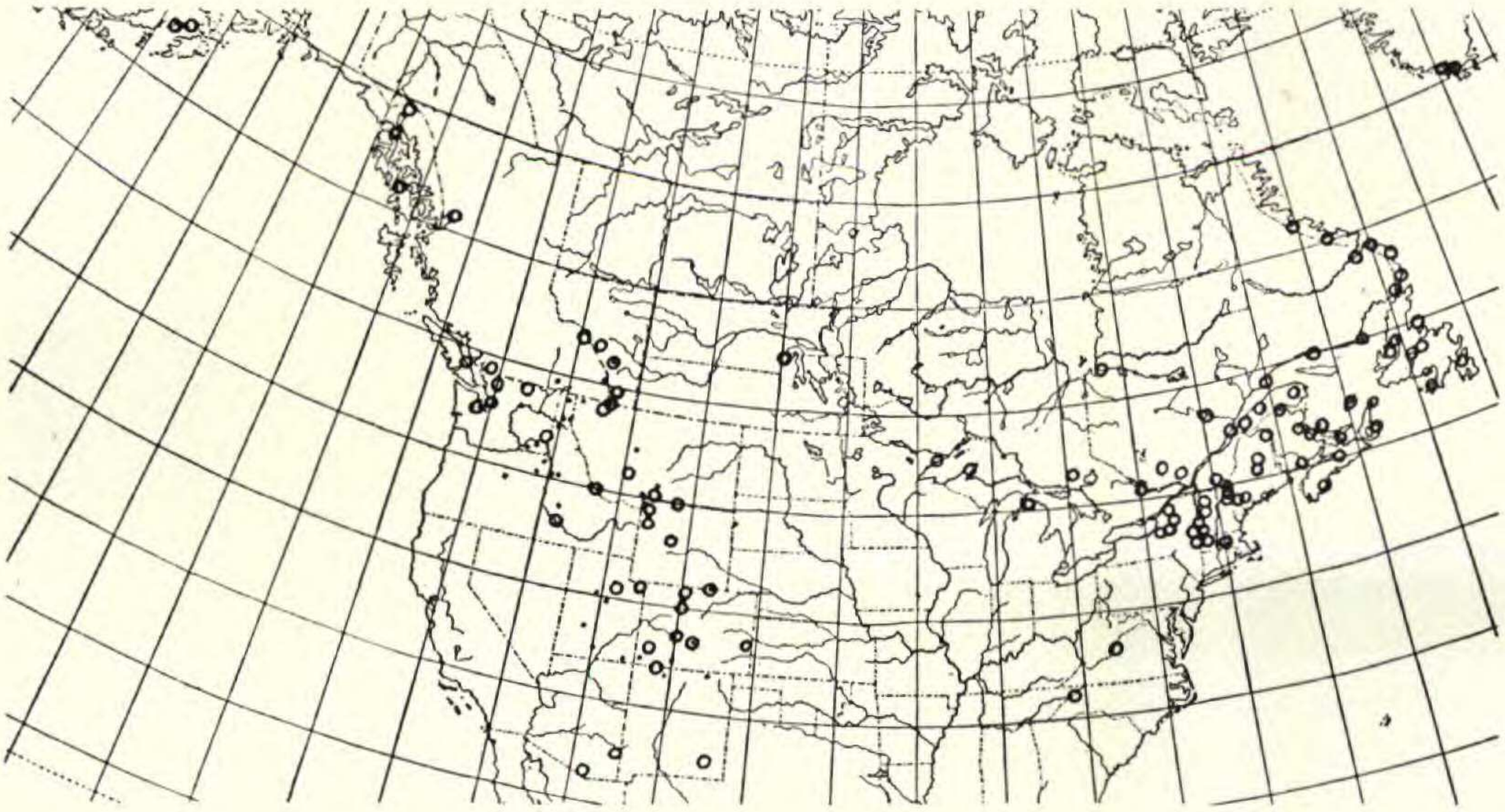
[1] Bot. Cal. ii. 178 (1880).

Some leaves do not show these papillae unless the source of light is placed very close to the surface, when they become clearly visible. None of the papillate-leaved plants have any trace of marginal teeth; none of the denticulate-leaved plants ever have any papillae.

It is not possible to separate the American plants specifically from the European, but strong tendencies are shown in two sets of characters. The European plants have in general longer pedicels (*i. e.*, the part between the flower and the twist or bracted point) than the American, as was noted many years ago,[1] and are usually provided with a greater number of sterile leaves on each branch distal to those associated with the flowers. While there is sometimes overlapping in these characters, particularly in the Rocky Mountains, where rarely occur long-pedicelled individuals approaching the European variety, they seem in combination sufficient to justify varietal separation.

S. AMPLEXIFOLIUS, var. **genuinus**. *Uvularia amplexifolia* L. Sp. Pl. i. 304 (1753).—Mountainous regions of southern Europe.

S. AMPLEXIFOLIUS, var. **chalazatus**, n. var., var. *americanum* simulans; foliis sine dentibus, subtus cum copiosis minutis papillis. (PLATE 328, FIG. 1).—Southern British Columbia and Washington to South Dakota and southern Utah and New Mexico (MAP 1, dots). TYPE in Herbarium of the University of Wisconsin: Wallowa Lake, Oregon, June 15, 1933, *H. P. Hansen*, no. 1100.



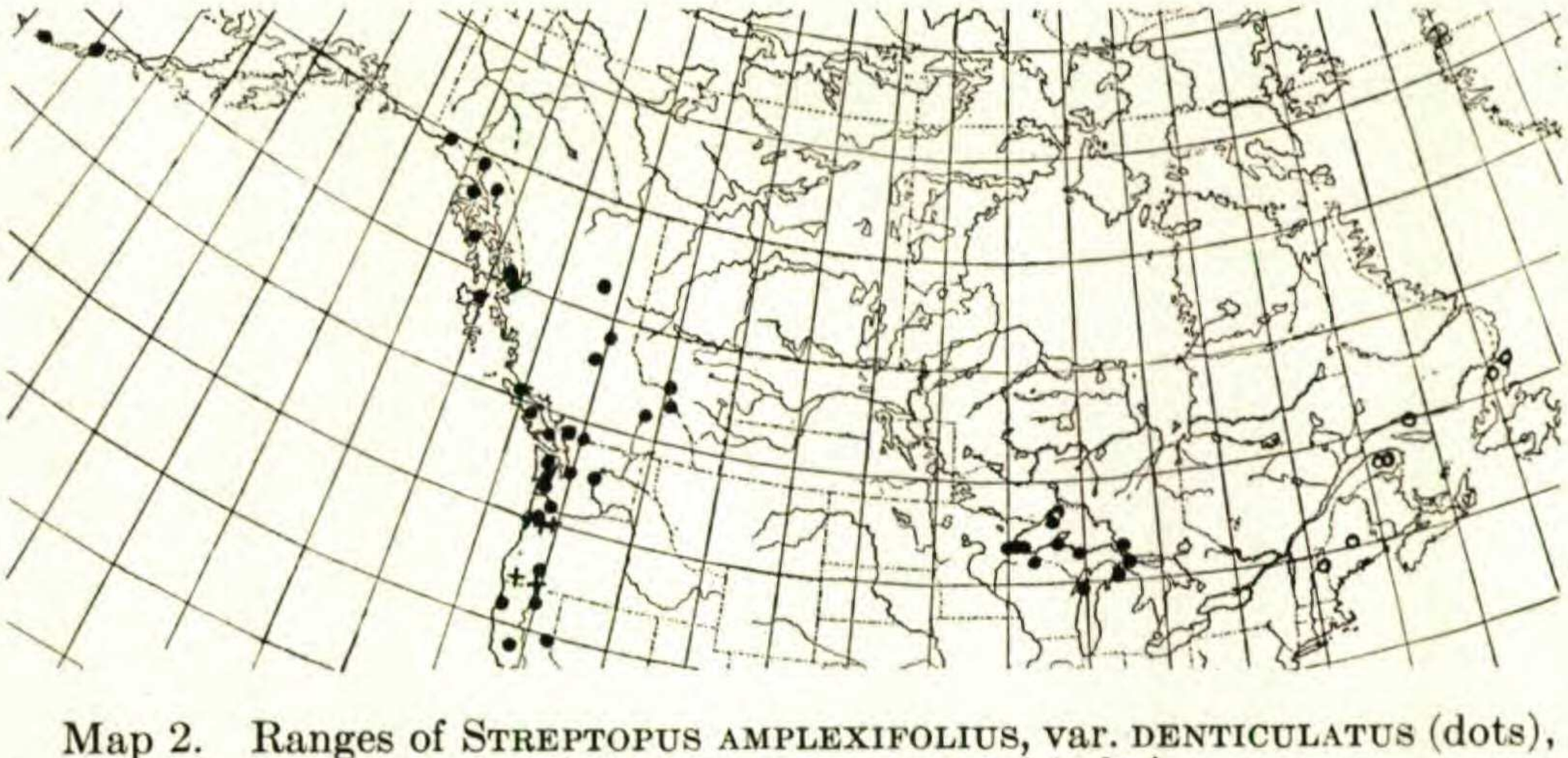
Map 1. Ranges of STREPTOPUS AMPLEXIFOLIUS, var. CHALAZATUS (dots) and var. AMERICANUS (circles).

[1] Don, Trans. Linn. Soc. xviii. 529 (1841).

S. AMPLEXIFOLIUS, var. AMERICANUS Schultes, Syst. Veg. vii. 311 (1829). *S. distortus* Michx. Fl. Bor.-Am. i. 200 (1803). (PLATE 328, FIG. o.)—Greenland to New England and northern New York, and to North Carolina in the mountains; rarely about the northern Great Lakes region where it grades into the next; Alaska to Washington, and in the mountains to Arizona and New Mexico (MAP 1, circles). Where this range overlaps that of var. *chalazatus*, the two plants apparently may occur together.

This also occurs in Kamchatka. Dr. Eric Hultén, who has been kind enough to examine his collections from that region, finds one of var. *americanus*, four distinctly var. *denticulatus*, and five intermediate. He also writes me that all material from the Aleutian Islands is clearly var. *denticulatus*, as is most of that from other parts of Alaska.

S. AMPLEXIFOLIUS, var. **denticulatus**, n. var., var. *americanum* simulans; foliorum marginibus cum minutis dentibus 10–25 per cm. (PLATE 328, FIGS. m, p & r).—About Lake Superior and the northern



Map 2. Ranges of STREPTOPUS AMPLEXIFOLIUS, var. DENTICULATUS (dots), var. GRANDIFLORUS (crosses) and var. OREOPOLUS (circles).

end of Lake Michigan; Aleutian Islands to northern California; Amur; Kamchatka. (MAP 2, dots). TYPE in Herbarium of the University of Wisconsin: wet wooded gully, Mellen, Wisconsin, June 7, 1934, *N. C. Fassett & Julius Popko*, no. 16716.

To the list of plants of the Pacific slopes of the continent which reappear about Lake Superior may be added *S. amplexifolius* var. *denticulatus*. Indeed, the combined range of this and the next variety bears a very close resemblence to that of the Devil's Club,[1] except that the latter has a much more restricted range in the middle west.

S. AMPLEXIFOLIUS, var. PAPILLATUS Ohwi, Tokyo Bot. Mag. xlv. 185 (1931).

The original description reads, "Caulis inferne papillis longis sparse

[1] See Fernald, Mem. Am. Acad. of Arts & Sci. xv. 257, map 22 (1925).

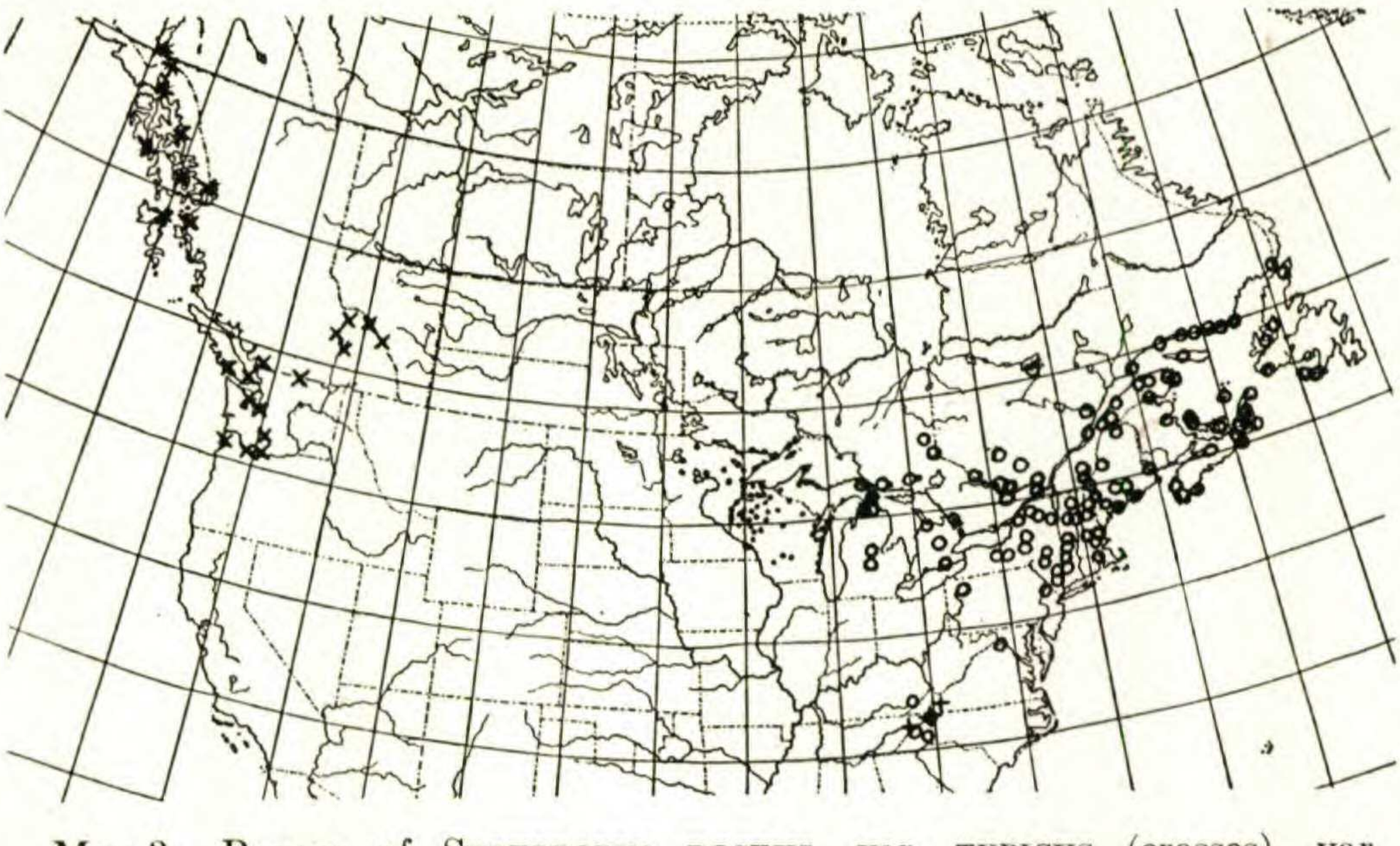
obsitus," indicating that its author was describing plants which develop a coarse pubescence toward the base of the stem. Such plants may occur anywhere throughout the range of *S. amplexifolius*. If the plant of Japan is recognized as a variety distinct from those of Europe and most of North America, the inappropriate name *papillatus* must be applied to it, and the variety redefined as follows: Leaves minutely denticulate, green both sides; perianth-segments 7–9 mm. long, with a spread of from 7–9 mm. In var. *americanus* small flowers are sometimes found, but with one exception the only denticulate-leaved plants with small flowers are from Japan. The exception is from shaded woods, Hoonah, Alaska, June 7, 1915, *Mr. & Mrs. E. P. Walker*, no. 683 (Gray). This specimen should probably be considered as var. *papillatus*, although the leaves are somewhat whitened beneath. Another specimen, no. 679, of the same habitat, locality, date, and collectors, is typical var. *denticulatus*.

S. AMPLEXIFOLIUS, var. **grandiflorus**, n. var., var. *denticulatum* simulans, sed foliis longioris latioribusque; floribus 13–17 mm. longis, 13–26 mm. extendentibus.—Western Oregon (MAP 2, crosses): wet rocks, Falls City, May 12, 1917, *J. C. Nelson*, no. 1143 (TYPE in Gray Herbarium); rocky banks of Wilson's River, 15 miles above Tillamook, April 21, 1928, *J. W. Thompson*, no. 4114 (Gray); rocky banks of Santian River, near Mehana, Marion County, May 9, 1928, *Thompson*, no. 4170 (Gray; U. S.); Wimer, May 26, 1892, *E. W. Hammond*, no. 391 (N. Y.; U. S.).

S. AMPLEXIFOLIUS, var. **oreopolus** (Fernald), n. comb. *S. oreopolus* Fernald, RHODORA viii. 70 (1906). (PLATE 328, FIG. q).—Newfoundland; Mingan Islands and Gaspé and Matane Counties, Quebec; Mt. Katahdin, Maine; Mt. Washington, New Hampshire (MAP 2, circles).

While this plant stands out as strikingly distinct from the *S. amplexifolius* var. *americanus* of northeastern America, a study of other varieties of *S. amplexifolius* throws doubt on the specific validity of *S. oreopolus*. Its leaves are copiously ciliate, thus differing from those of the representative of *S. amplexifolius* common in the region, but the western *S. amplexifolius* var. *denticulatus* approaches it in this character; PLATE 328, FIG. r, shows the leaf-margin of a plant from Oregon, which, had it been collected in the region where *S. oreopolus* is found, would certainly have been treated with it. *S. oreopolus* often has ciliate pedicels and peduncles, but they may be glabrous as in other varieties of *S. amplexifolius*. The perianth-segments of *S. oreopolus* are always copiously papillate within; while the other varieties of *S. amplexifolius* often lack this character, occasional specimens show well-developed papillae. The dark red flowers of *S.*

oreopolus differ conspicuously from the whitish or greenish ones of its neighbor, *S. amplexifolius* var. *americanus*, but for the flowers of the European plant we find such descriptions as "weiss, aussen rötlich oder grünlich,"[1] or "aussen grünlich-gelb, innen weiss mit röthlichem Anflug,"[2] or "white, with a reddish tinge."[3] Turning to illustrations of the European plant, we find that, while some show white[3,4] or yellow[5] perianths, others[6] indicate a pinkish tinge, or even deep red[2,7] toward the base. While most authors describe the flower of the western American plants as white or greenish,[8] others[9] include the term "or purplish" in the description. Concerning the plant



Map 3. Ranges of STREPTOPUS ROSEUS, var. TYPICUS (crosses), var. PERSPECTUS (circles), var. LONGIPES (dots) and var. CURVIPES (x's).

of eastern Asia we find "flores sordide rosei"[10] and "flowers white, shaded rose-purple."[11] A specimen from Tillamook County, Oregon (June 25, 1894, *F. E. Lloyd*, in New York Botanical Garden) bears the

[1] Hegi, Ill. Fl. Mitt.-Eu. ii. 268 (1909).
[2] Schlechtendal, Lang & Schenk, Fl. Deutschl. ed. 5, iv. 13 (1880).
[3] Seboth & Bennett, Alp. Pl. iii. 51 (1880).
[4] Hartinger, Atlas Alpenfl. 450 (1884).
[5] Redouté, Liliac. v. t. 259 (1819).
[6] Peterman, Deutsch. Fl. 570, t. 89, fig. 702 (1894).
[7] Reichenbach, Ic. Fl. Germ. x. t. 431 (1848).
[8] Watson, Bot. Cal. ii. 178 (1880); Howell, Fl. N.-W. Am. i. 658 (1903); Frye & Rigg, Northwest Flora 109 (1912); Piper, Fl. Wash., in Contrib. U. S. Nat. Herb. xi. 201 (1906); Gilkey, Spring Flora of Northwestern Oregon 9 (1929).
[9] Coult. & Nelson, Man. Bot. Central Rocky Mts. 119 (1909); Clements & Clements, Rocky Mt. Flowers 310 (1914).
[10] Maxim., Primit. Fl. Amur. 274 (1859).
[11] Diels, Pl. Chin. Forrest. 272 (1912).

annotation "perianth red," and a sheet from Mt. Selwyn, British Columbia (*Raup & Abbe*, no. 4178, in the Gray Herbarium) clearly shows pink flowers. The type collection of *S. amplexifolius* var. *denticulatus* has the perianth-segments flecked with deep pink within.

It is perhaps significant that *S. amplexifolius* var. *oreopolus*, so distinct from the wide-ranging var. *americanus*, and occupying an area known to have many species of ancient distribution,[1] should approach on the one hand *S. amplexifolius* var. *genuinus* of southern Europe but not the more northern extensively glaciated portions of that continent, and on the other hand vars. *denticulatus* and *papillatus*, whose combined ranges almost coincide with that of the Devil's Club. MAP 4 shows the disrupted ranges of this plant and its allied varieties:

Map 4. Ranges of STREPTOPUS AMPLEXIFOLIUS, var. GENUINUS (so. Europe), var. OREOPOLUS (e. North America), var. DENTICULATUS (Great Lakes reg., w. North America and Kamchatka) and var. PAPILLATUS (Japan).

in Europe, *S. amplexifolius* var. *genuinus;* in eastern North America, var. *oreopolus;* in the Great Lakes region, western North America, and Kamchatka, var. *denticulatus;* in Japan, var. *papillatus*.

It has been suggested that *S. oreopolus* may be a hybrid of *S. amplexifolius* [var. *americanus*] and *S. roseus*.[2] Victorin[3] points out that a cross of two plants, one with a flower practically white and the other with rose-colored flowers, would scarcely be expected to have a dark red perianth. To this may be added the observation that *S. oreopolus* has the perianth-segments conspicuously papillate within, while *S. amplexifolius* var. *americanus* rarely has well-developed papillae, and the representative of *S. roseus* occurring in that region lacks papillae of the type found in the purported hybrid. Furthermore, if *S. amplexifolius* and *S. roseus* can hybridize, why do they

[1] See Fernald, Mem. Am. Acad. of Arts & Sci. xv. no. III (1925).
[2] Fernald, RHODORA ix. 107 (1907).
[3] Contrib. Lab. de Bot. Univ. de Montréal xiv. 21 (1929).

not do so in the many other places where their ranges overlap, instead of only in one limited region? In short, when we consider the floral morphology of *S. oreopolus*, and its apparently close relationship to the western forms of *S. amplexifolius*, keeping in mind the numerous other plants of the Gulf of St. Lawrence region which also show relationship to western forms, it seems less likely that it is a hybrid of local origin than that it is a relic, closely allied to certain varieties of *S. amplexifolius*, which are found in remote regions.

On Mount Washington, New Hampshire, just above Tuckerman's Ravine, may be found a most interesting series of variations of *S. amplexifolius*. Var. *oreopolus* is abundant, and var. *americanus* can also be found. A third type of plant has denticulate leaves like those of var. *denticulatus*. Since its leaf-margin is intermediate between that of var. *americanus* and that of var. *oreopolus*, and, in addition, the lower leaf-surface is less glaucous than in the former, but more so than in the latter, it is considered as a hybrid of these two varieties. The flowers, which were just beginning to open when observed by the writer on June 27, 1934, were nearly white and conspicuously papillate within. Perhaps some New England amateur will find it possible to study these variations throughout a season. The expanded flowers should be observed, especially for correlation of perianth-color with degree of toothing on the leaf-margin, and the fruit-colors should be noted.

4. S. **obtusatus**, n. sp., planta glabra; foliis amplexicaulibus, marginibus ciliatus; perianthiis campanulatis, segmentis obtusis; antheris filamentibus subaequalibus, basi cordatis, triangularibus, apicibus bifidis; stigmatibus 3-lobis 2/3 ad basem; baccis rubris. (PLATE 328, FIG. e.)—SZECHWAN, CHINA: Baurong to Tachienlu, via Hadjaha, alt. 9000–15500 ft., May–June, 1929, *Herbert Stevens*, no. 422 (TYPE in Herb. Field Museum); Tachienlu to Sachou, via Mouping, alt. 9200–12200 ft., August–September, 1929, *Stevens*, no. 80 (Field). The following probably belongs here: western Szechuan, *E. H. Wilson*, no. 4663 (Gray).

While the leaves of this species are very similar to those of *S. amplexifolius*, the floral characters place it unquestionably as a close relative of *S. roseus*. *S. roseus* and *S. obtusatus*, then, stand out as one more pair of closely related but very distinct species, one appearing in North America, and the other in Asia.

Fruiting specimens may be mistaken for *S. amplexifolius*, from which they may be distinguished by their uppermost leaves, which are not cordate and are somewhat oblique at base, rather than clasping and essentially equal at base as in *S. amplexifolius*. The leaf-margins

have 28–40 teeth per centimeter, more than are found in any form of *S. amplexifolius* except var. *oreopolus*.

5. S. ROSEUS Michx. Fl. Bor.-Am. i. 201 (1803).

The fact that all Wisconsin specimens identified as *S. roseus* which show underground parts have long rootstocks, the character of *S. longipes*, has led to a consideration of other possible distinctions between these two so-called species. Such characters have been sought in rootstocks, branching of stem, ciliation of leaves, the peduncles and pedicels, perianth, pistil and stamens, and fruit and seeds. *S. longipes* appears to be intermediate between *S. roseus* and the western *S. curvipes* and the writer is led reluctantly to the conclusion that these three plants intergrade to such an extent that they cannot be maintained as species.

ROOTSTOCKS. It was because of its slender and wide-creeping rootstock that *S. longipes* was first separated from *S. roseus*. F. C. Gates, studying the plants in the field in northern Michigan (Lower Peninsula) states[1] that the "length, thickness, branching and abundance of roots varied to both extremes with the variation in the character of the soil from good hardwood to pine land soil." While driving from Thessalon, Ontario, through Sault Ste. Marie and into the Upper Peninsula of Michigan, on September 11, 1932, the present writer had opportunity to observe the behavior of rootstocks in a region where the ranges of *S. roseus* and *S. longipes* overlap (see MAP 3). PLATE 328, FIG. a, shows a rootstock from this region which is of the *S. roseus* type; this is a close match for specimens collected by the writer in Maine. FIG. b shows another rootstock from the same region; this is clearly the *S. longipes* type, found from Michigan westward. But the identity of the plant shown in FIG. c is not so obvious, although some other plants in the same colony were much more like *S. longipes*. FIG. d illustrates another type of intermediate, in which the rootstock has been of a *roseus* type for some years, but is abruptly taking on the character of *S. longipes*. It may be noted here that in the Flora of the State of Washington *S. curvipes* is reduced outright to *S. roseus*, with the comment, "The western form of this species is commonly smaller than that of the eastern States, and shows a tendency to produce longer rhizomes, but we believe these differences are not specific, especially as rhizomatous forms occur also in the Allegheny Mountains."[2] We may conclude, then, that the plant of the middle west has

[1] RHODORA xiii. 237 (1911).

[2] Piper, Contrib. U. S. Nat. Herb. xi. 202 (1906). No plants with elongate rootstocks were found among the specimens from the Alleghenies examined in the present study.

a strong tendency to produce longer rootstocks than does the plant of the east, and whether or not this warrants specific recognition must be considered with its relation to other differences.

Branching of Stems. Here we find strong tendencies, but none sufficient for specific differentiation. *S. roseus* is usually branched, *S. longipes* often branched, and *S. curvipes* rarely branched. Dr. Butters writes me from Minnesota: "Of the specimens at hand 95% of the *curvipes* is unbranched, 54% of the *longipes*, and only 20% of true *roseus*." The following data, approximating those of Dr. Butters, were derived from the material in the herbaria of the University of Wisconsin, the New York Botanical Garden, the United States National Museum, and the University of Montreal.

	S. roseus, 196 plants.	S. longipes, 74 plants.	S. curvipes, 91 plants.
Simple	13%	62%	96%
2-branched	31%	16%	4%
3-branched	39%	15%	
4-branched	15%	6%	
5-branched	1%	1%	
6-branched	1%		

These figures may be compared with those taken in single patches in the field. On July 2, 1933, a count was made on *S. roseus* about the Lake of the Clouds, on Mount Washington, New Hampshire. Again, 100 individuals of *S. roseus* were examined in pine woods at Whitefield, Maine, on August 3, 1933. *S. longipes* was studied in the Barron Hills, Rusk County, Wisconsin, where 100 plants were observed. The results may be compared in a table. In all cases only flowering individuals were counted.

	S. roseus Mt. Washington, N. H.	S. roseus Whitefield, Maine.	S. longipes. Barron Hills, Wisconsin.
Simple	18	11	52
2-branched	50	45	38
3-branched	30	32	9
4-branched	2	8	1
5-branched		3	
6-branched		1	

So, as was expected from the study of herbarium material, the individuals of *S. roseus* in woods at low altitudes proved to have a tendency to branch more than those in the alpine regions of Mt. Washington, but even the latter were more freely branching than those of *S. longipes* growing in the woods.

Ciliation of Leaves. Here we find strong tendencies, but no clear-cut distinctions. In *S. roseus* the number of cilia per centimeter varies from 30 to 50, but on occasional plants they may run as low as 22 or as high as 60 per centimeter. The best way to observe this is with a binoccular microscope, a strip of black paper one centimeter wide being inserted under a loose leaf-edge. In *S. longipes* there are rarely more than 30 cilia per centimeter, although on a few plants, otherwise characteristic, they reach 38 per centimeter, or even 60 per centimeter in some; they may be as sparse as 14 per centimeter. The average number in *S. roseus* is about 34, and in *S. longipes* about 25.

In *S. curvipes* they are usually less abundant. The length of the cilia, while so variable as to have little diagnostic value, is seldom over 0.3 mm. in *S. roseus*, and often reaches 0.4 or 0.5 mm. in *S. longipes*. In *S. curvipes* they are usually much shorter than in *S. roseus*.

Peduncles and Pedicels. These are very variable, their combined length being sometimes as little as 5 or 6 mm. in all the species, but the upper limit of variation is much less in *S. curvipes* than in the others.

Perianth. In the venation of the perianth-segments seems to lie one of the most satisfactory distinctions between the so-called species. In *S. roseus* the sepals are 9–11-nerved (rarely only 7-nerved) and the petals are 7-nerved, while in *S. longipes* and *S. curvipes* the sepals are 5–7-nerved and the petals are 3–5-nerved. But occasional exceptions may be found, when plants otherwise agreeing with *S. longipes* have 9-nerved sepals. Also, if flowers of *S. longipes* are boiled and observed with transmitted light, many small branch-nerves appear; thus, a petal from a plant collected by the writer at Merrimac, Wisconsin, is when dry distinctly 5-nerved, but after boiling it shows with transmitted light eleven nerves of varying lengths.

Another perianth character has been called to my attention by Dr. Butters. In *S. longipes* and *S. curvipes* the inner surface of the perianth-segments almost always has copious short papilla-like hairs (plate 328, fig. k), longer in *S. curvipes* than in *S. longipes*. These are rarely developed in *S. roseus*, which sometimes has what appear to be, in dried flowers, appressed or elongate very fine hairs. Under the microscope these appear as long low papillae (plate 328, fig, j). But a series of specimens collected by the writer in Rusk County, Wisconsin, while having characteristic *longipes* rootstocks, have the many-veined and non-papillate perianth-segments of *S. roseus*, and numerous

other exceptions have been noted on several herbarium sheets. Professor Butters has also pointed out to me that the stamens of *S. longipes* are usually 3/5 to 2/3 the length of the perianth-segments, while those of *S. roseus* are ordinarily only about ½ the length of the perianth-segments; however, the number of exceptions is so great as to destroy the value of this as a really diagnostic character.

Pistils and Stamens. Here, Dr. Butters has pointed out to me two tendencies. The bases of the filaments, which are in all cases fused with the perianth, are in *S. roseus* often fused with each other, and are less often so in *S. longipes*. Well developed stigmas are usually more widely spreading in *S. longipes* than in *S. roseus*.

Fruit and Seeds. The seeds are, as far as the writer can determine, identical in *S. roseus*, *S. longipes*, and *S. curvipes*. As for the fruits, Gates distinguishes *S. longipes*, with berry subglobose in general shape and triangular in cross-section with very obtuse angles, from *S. roseus*, with more or less globose fruit which is circular in cross-section.[1] It is, of course, impossible to tell from pressed specimens how generally this holds. The writer has berries preserved in alcohol, representing the following collections: *S. longipes:* Parfrey's Glen, Merrimac, Wisconsin, July 16, 1932, *N. C. Fassett*, no. 14381; same location, July 24, 1932, no. 14382. *S. roseus:* Ocean Point, Maine, July 28, 1932, *Mrs. L. J. Fassett & Ellen Denike;* Ocean Point, Maine, August 4, 1932, *Josephine W. Chute;* White Island, Boothbay, Maine, July, 1933, *J. H. Fassett;* Garden River, Ontario, August 20, 1932, *N. C. Fassett*, no. 14700. In all of these the berries are triangular in cross-section when young, becoming more turgid as they mature; those of *S. roseus* appear to be more turgid than those of *S. longipes*. There should be more observation of this character in the field, and more herbarium specimens should be accompanied by preserved fruits.

S. longipes, then, resembles *S. roseus* in the length of cilia on the leaves; it is intermediate between *S. roseus* and *S. curvipes* in branching and the amount of ciliation on the leaves; and it resembles *S. curvipes* in the rootstock and the perianth. In view of these facts, these plants seem best treated as three geographic varieties of one species.

Since the categories in which we place plants are to a great extent but human conceptions and rest on individual opinions, I may be pardoned if I introduce some personal experiences. In the summer of

[1] Rhodora xiii. 237 (1911).

1931 I studied this group in the Gray Herbarium, and came to the conclusion that *S. roseus* and *S. longipes* were two perfectly distinct species, separable on a number of characters, and with ranges that did not overlap. Later, a study of more ample material from the middle west convinced me that this idea was incorrect. In 1911 Professor F. C. Gates wrote as follows: "Accordingly *Streptopus longipes* has demonstrated its specific validity and to its description should be added the words: fruit subglobose, trigonous in cross-section with obtuse angles."[1] On December 12, 1932, Professor Gates wrote to me as follows: "In reply to your letter regarding *Streptopus longipes:* in the early days of the station [at Douglas Lake, Cheboygan County, Michigan], *Streptopus* was present in many of the beech-maple forests. We found specimens which had the root character what Fernald used in describing *Streptopus longipes* together with the trigonous fruit character. We found other plants which had an entirely different root character with globose fruits. In those days, we considered the one with trigonous fruit as *Streptopus longipes* as the root character usually, but not always, agreed with that. As time has gone on, the forests have been lumbered and at present there are not sufficient data in the Douglas Lake region to give one any satisfaction regarding what is what. We have felt that if the two are separate species, they have hybridized and succeeding generations have broken up in different ways, which would explain the differences in combination of these two characters. As I have not had any opportunity to study *Streptopus* except in the Douglas Lake region, I really cannot answer your question at the present time. It could, of course, be that farther west, one is present without the other, and it could be that there is only one species which varies under different conditions. At the Biological Station of late years, we have been inclined more toward the latter explanation than the former, but as I said before, will have to admit that the widespread destruction of the forests has resulted in the dying off of *Streptopus* and we find insufficient data to settle the question."

It is a pleasure to acknowledge the coöperation of Professor F. K. Butters, who has pointed out a number of distinctions between *S. roseus* and *S. longipes*, as has already been mentioned. Like the present writer, he at first considered that they were very distinct species, but on February 1, 1933, after we had both made a thorough study of the material in the herbaria of the University of Minnesota

[1] Rhodora xiii. 237 (1911).

and of the University of Wisconsin, Dr. Butters wrote me as follows: "Now as to the taxonomy of the two forms, it seems to me that they are just about on the border line between species and varieties. . . I am not much worried about the undoubted intermediates that occur in Michigan. It seems to me that these are best explained as the result of recent hybridity between the two entities, where their gradually extending ranges have overlapped. I don't think such intergrades occurring in a limited district are sufficient in themselves to reduce the intergrading forms to the status of varieties rather than species. More troublesome is the fluctuating and apparently unfixed condition of most of the characters. All things considered I am inclined to think your disposition of them is best. Of course, whatever you do with *S. longipes* will have to be done also with *S. curvipes*. Those two forms are very closely related, I think more closely than either is related to true *S. roseus*. . . . Isn't this another case of the relationship of plants of the general Lake Superior region with those of the northern Cordillera?"

In the preceding paragraphs, the names *S. roseus*, *S. longipes*, and *S. curvipes*, have been used for the common plants of the eastern states, the middle west, and the far west, respectively. In the seventh edition of Gray's Manual the range of *S. longipes* is limited to one county in Upper Michigan; this is too restricted, for it occurs in Minnesota, Wisconsin and much of Michigan, to the exclusion of *S. roseus*.

A fourth phase of this group occurs in the southern Alleghenies, where many of the plants have perfectly glabrous peduncles and pedicels (flower stalks, if not branching, usually bear near the middle a little callus; the part above this callus is considered to be pedicel, and below it peduncle). The habitat of *S. roseus* as given by Michaux ("in excelsis montibus Carolinae septentrionalis et in Canada") suggests that the type of the species may be the glabrous-peduncled plant. This possibility is heightened by Michaux's plate illustrating this species, for a plant with glabrous pedicels and peduncles is shown. However, this plate is so inaccurate, showing no ciliation on the leaves, and twisted flower-stalks like those of *S. amplexifolius*, that it seems best to leave it out of consideration. An illustration of a little later date[1] also shows glabrous flower-stalks, with ciliate leaves.

The question of the identity of the plant of Michaux is solved by a letter to the writer from M. François Pellegrin, in which he says:

[1] Lodd. Bot. Cab. xvii. t. 1603 (1830).

"l'échantillon de *Streptopus ciliatus*[1] de l'herbier Michaux a les péduncules et pédicelles entièrement glabres." The local plant of the southern mountains must, then, be taken up as type, and the more wide-spread phase taken up as a new variety.

S. ROSEUS Michx., var. **typicus**. *S. roseus* Michx. Fl. Bor.-Am. i. 201 (1803), excluding reference to Canadian plant. PLATE 328, FIGS. g & i; MAP 3, crosses.—VIRGINIA: south slope of White-top Mt., May 28, 1892, *E. W. Cathcart* (U. S.); summit of White-top Mt., Washington County, May 28, 1892, *N. L. & E. G. Britton & Anna M. Vail* (N. Y.); northeast slope of White-top Mt., Smythe County, May 28–29, 1892 (Field). NORTH CAROLINA: Grandfather's Mountain, altitude 5000–5800 ft., July 10–12, 1925, *P. A. Rydberg*, no. 9342 (N. Y.); Roan Mountain, June, 1878, *M. E. Hyams* (N. Y.); Roan Mountain, June, 1879, *A. Gray, C. S. Sargent, J. H. Redfield & W. M. Canby* (Gray). The following specimens are intermediate between this and the next variety: PENNSYLVANIA: Conashaugh, July 6, 1890, *N. L. Britton* (N. Y.). VIRGINIA: north-east slope of White-top Mountain, Smythe County, altitude 4000–5000 ft., May 28–29, 1892, *J. K. Small* (U. S.; Field). NORTH CAROLINA: Richland Balsam Mt., Haywood County, 5000 ft. altitude, May 21, 1911, *H. D. House*, no. 4574 (U. S.); Roan Mountain, 1894, *Dr. H. A. Edson* (U. S.); summit, 6300 ft., Roan Mountain, July 15, 1880, *John Donnell Smith* (U. S.); along streams on northern slopes of Craggy Mountain, Buncombe County, May 25, 1897, *Biltmore Herbarium*, no. 4665 (U. S.; N. Y.); along mountain streams near Highlands, Macon County, May 24, 1897, *Biltmore Herbarium*, no. 4665b (N. Y.); high mountains of North Carolina, June, 1868, *Wm. M. Canby* (U. S.); ravines, 3500 ft. altitude, "Pink Beds," Pisgah Forest, Transylvania County, May 8, 1909, *H. D. House*, no. 4142 (U. S.).

The line between var. *typicus* and var. *perspectus* is drawn at perfectly glabrous pedicels rather than to include in the former variety those plants with much reduced ciliation because such nearly glabrous ones are occasionally found throughout the range of var. *perspectus*, while completely glabrous ones seem to be confined to the southern mountains.

Among the tendencies shown by individuals of *Streptopus roseus* from the southern Alleghenies is a lack of cross-veins in the leaves in many plants. But since this is not universal in the region, and is occasionally found in other parts of the range of *S. roseus*, it is here recognized with no more than this note.

S. ROSEUS, var. **perspectus**, n. var., rhizomate cum internodiis curtissimis (PLATE 328, FIG. a); pedunculis pedicellisque ciliatis (FIGS. f.

[1] The type specimen, in the herbarium of Michaux, is marked *Streptopus ciliatus; roseus* has been written on the label by another's hand. See Victorin, Contrib. du Lab. de Bot. de l'Univ. de Montréal xiv. 24 (1929).

& h); sepalis (7–) 9–11-nervis; sepalis petalisque intra non papillatis (FIG. e).—Southern Labrador, Newfoundland, and Quebec to northern New Jersey and western Pennsylvania, southward in the mountains to Virginia, Tennesee, and North Carolina (where it intergrades with the preceding), Georgia (according to Chapman), westward through southern Ontario to central Michigan and the eastern extreme of the Upper Peninsula of Michigan, where it intergrades with var. *longipes*. (MAP 3, circles).—TYPE in the Herbarium of the University of Wisconsin: under trees, floor of Tuckerman's Ravine, Mt. Washington, New Hampshire, June 27, 1934, *N. C. Fassett*, no. 16422.

S. ROSEUS, var. PERSPECTUS, f. **giganteus**, n. f., caulis crassus; sepalis 10–12 mm. longis; staminibus 5–7 mm. longis; aristis antherarum 0.5–1.0 mm. longis; stigmatibus 1.1 mm. longis.—Talus de l'escarpment, avec *S. amplexifolius* & *S. oreopolus*, Ile Nue, Archipel de Mingan, Québec, 28 juillet 1926, *Victorin & Rolland*, no. 24336 (TYPE in the Herbarium of the University of Montreal).

This collection is unique among those studied by the writer, in that the stems are a centimeter thick (when pressed) below the first branching, and the floral parts are much larger than those of the ordinary plants. It appears to be a polyploid of the nature of *Oenothera gigas*. There are two sheets in the herbarium of the University of Montreal, and one in that of the University of Wisconsin, bearing this number; all are f. *giganteus*, while other collections from the same locality bear flowers of normal size.

S. ROSEUS, var. **longipes** (Fernald), n. comb. *S. longipes* Fernald, RHODORA viii. 71 (1906).—Southern Ontario, northwestern Pennsylvania,[1] northern Michigan and Wisconsin to western Minnesota and southern Manitoba (MAP 3, small dots).

S. ROSEUS, var. **curvipes** (Vail), n. comb. *S. curvipes* Vail, Bull. Torr. Bot. Cl. xxviii. 267 (1901). *S. roseus* Piper, Contrib. U. S. Nat. Herb. xi. 202 (1906). *S. brevipes* Fernald, RHODORA viii. 69 (1906), not Baker. (PLATE 328 FIG. k).—Alaska to southeastern British Columbia and northern Oregon (MAP 3, *x*'s).

6. S. STREPTOPOIDES (Ledeb.) Frye & Rigg, Northwest Flora 109 (1912). *Smilacina streptopoides* Ledeb. Fl. Ross. iv. 128 (1853). *Kruhsea Tilingii* Regel ex Regel & Tiling, Fl. Ajanensis 122 (1858). *Streptopus ajanensis* Tiling ex Regel & Tiling, l. c. (*nomen nudum*).

Within the eastern Asiatic and western North American *S. streptopoides* we find a series of variations very similar to those within *S. roseus*. The following treatment must be considered as provisional; the final understanding of the Asiatic plants must rest upon a study of a large series of specimens and upon field observation.

S. STREPTOPOIDES, var. **verus**. *Smilacina streptopoides* Ledeb. l. c.

[1] Specimens seen at Carnegie Museum since MAP 3 was engraved.

Specimens seen: SIBERIA: Ayan, Ochotsk Sea, *C. Wright* in 1853–56 (Gray, U. S.); Ayan, *Tiling* (Gray).

S. STREPTOPOIDES, var. **brevipes** (Baker), n. comb. *S.* ? *brevipes* Baker, Journ. Linn. Soc. xiv. 592 (1875). *Kruhsea Tilingii* Baker, l. c., 593 in part. *K. Tilingiana* Farr, Contrib. Bot. Lab. Univ. Pa. ii. 417 (1904).—Alaska to Washington, east to Idaho and southeastern British Columbia.

PLATE 328, FIG. n, shows the characteristic rounded hyaline cells of the leaf-margin. While considerable magnification is required to see this, it is quite unmistakable and does not occur elsewhere in the genus.

The name *S. brevipes* has sometimes been applied to *S. roseus* var. var. *curvipes;* a specimen in the Gray Herbarium, Cascade Mts., 49 N. Lat., 1859, *Dr. Lyall*, appears to be the type, and while it is in fruit, its leaf character places it unquestionably with *S. streptopoides.*

S. STREPTOPOIDES, var. **japonicus** (Maxim.), n. comb. *S. ajanensis*, var. *japonica* Maxim. Mel. Biol. xi. 856 (1883); Matsumura, Ind. Pl. Jap. 214 (1905). *S. japonicus* Ohwi, Tokyo Bot. Mag. xlv. 189 (1931). *S. streptopoides* Matsum. Ic. Pl. Koisikav. i, pl. 54 (1912), which represents the larger forking plant without long rootstocks.—Northern Japan and Yezo.

S. STREPTOPOIDES, var. ATROCARPUS Matsum. l. c., p. 107. *S. japonicus*, var. *atrocarpa* Ohwi, Tokyo Bot. Mag. xlv. 189 (1931).

The relation of this to var. *japonicus* could not be determined from the material at hand. All the Japanese specimens of *S. streptopoides* studied were of the stout branched type; some had a long rootstock like that shown in PLATE 328, FIG. b, while others had a short rootstock like that in FIG. a. The color of the berry was not distinguishable.

7. S. KOREANUS (Komarov) Ohwi, Tokyo Bot. Mag. xlv. 189 (1931). *S. ajanensis*, var. *Koreana* Komarov, Fl. Mansh. i. 476 (1901); Nakai, Fl. Koreana ii. 246 (1911).—Specimen studied: flum. Jumin-gan, Korea septentrionalis, July 13, 1897 (styl. vet.), *V. Komarov*, no. 407 (Gray; N. Y.).

KEYS FOR LOCAL USE

A few keys are here presented which may be of use in identifying specimens from various parts of North America.

For the area from Labrador and western Quebec southward:

a. Nodes glabrous; leaves clasping at base; fruit elongate; perianth-segments widely spreading or recurved *b*
  b. Leaves whitened beneath, their margins entire or essentially so; peduncles and pedicels always glabrous; perianth greenish white; fruit scarlet.....*S. amplexifolius* var. *americanus.*
  b. Leaves green beneath, their margins denticulate to ciliate; peduncles and pedicels often ciliate; perianth deep red; fruit cherry-red.....*S. amplexifolius* var. *oreopolus.*

a. Nodes fringed; leaves not clasping; fruit globose; perianth-segments not recurved *c*
c. Pedicels, and often the peduncles, glabrous . . . . . *S. roseus* var. *typicus.*
c. Pedicels and peduncles ciliate *d*
d. Stem rarely more than 5 mm. thick at the first branching; perianth 6–10 mm. long . . . . . *S. roseus* var. *perspectus.*
d. Stem 1 cm. or more thick at the first branching; perianth 10–12 mm. long . . . . . *S. roseus* var. *perspectus* f. *giganteus.*

For Ontario, Manitoba, Michigan, Wisconsin and Minnesota:

a. Nodes glabrous; leaves clasping at base, their margins entire or minutely denticulate; perianth-segments widely spreading or recurved *b*
b. Leaf-margins entire or with fewer than 10 teeth per centimeter . . . . . *S. amplexifolius* var. *americanus.*
b. Leaf-margins with 10–25 teeth per centimeter. *S. amplexifolius* var. *denticulatus.*
a. Nodes fringed; leaves not clasping, their margins copiously ciliate; perianth-segments not recurved except at tip *c*
c. Rootstock with crowded nodes; leaf-margins with usually more than 30 cilia per centimeter; sepals (7–)9–11-nerved, not papillate within . . . . . *S. roseus* var. *perspectus.*
c. Rootstocks with internodes several centimeters in length; leaf-margins with usually less than 30 cilia per centimeter; sepals 3–5-nerved, minutely papillate within. *S. roseus* var. *longipes.*

In the area from Montana to New Mexico, west to the continental divide and east to South Dakota, will be found only *S. amplexifolius*, occurring as two varieties: var. *chalazatus* has the leaves minutely papillate beneath, while var. *americanus* does not. The writer is not familiar with these in the field, but from a study of herbarium material it appears that they may grow together. Observers in this region may discover some differences in habit, fruit or habitat.

For the west slopes of the Rockies to the Pacific coast:

a. Large usually branching plants often reaching a meter in height; nodes glabrous; perianth-segments spreading from about the middle *b*
b. Leaf-margins entire or with not more than 10 minute teeth per centimeter *c*
c. Leaves papillate beneath . . . . . *S. amplexifolius* var. *chalazatus.*
c. Leaves not papillate beneath . . . . . *S. amplexifolius* var. *americanus.*
b. Leaf-margins with 10 or more teeth per centimeter. *S. amplexifolius* var. *denticulatus.*
(Vars. *grandiflorus* and *papillatus* occur locally)
a. Small rarely branching plants seldom more than 3 dm. high; nodes fringed; perianth campanulate or rotate *d*
d. Perianth campanulate; leaf-margins with multicellular irregularly spaced cilia or entire . . . . . *S. roseus* var. *curvipes.*
d. Perianth rotate; leaf-margins with microscopic unicellular hyaline closely crowded teeth . . . . . *S. streptopoides* var. *brevipes.*

Explanation of Plate

Fig. a, Streptopus roseus var. perspectus, rootstock × ½, from Garden River, Ontario, *Fassett*, no. 14655 (U. of Wis.). Fig. b, S. roseus var.